भारतीय मानक
Indian Standard

IS 9200 : 2021

अनुपयोगी संपीडित गैस सिलिंडरों के निपटान की पद्धतियाँ — रीति संहिता

(दुसरा पुनरीक्षण)

Methods of Disposal of Unserviceable Compressed Gas Cylinders — Code of Practice

(Second Revision)

ICS 23.020.30

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November 2021 **Price Group 8**

Gas Cylinders Sectional Committee, MED 16

FOREWORD

This Indian Standard (Second Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Gas Cylinders Sectional Committee had been approved by the Mechanical Engineering Divisional Council.

This standard was first published in 1979 and revised in 1988. This standard is revised to ensure the administration of proper safe method for the disposal of unserviceable gas cylinders and disposal of gaseous chemicals and their mixtures content therein. This standard reflects the concern of the Industrial gas Industry to ensure that standards of health, safety and environmental quality continue to be maintained. When the need arise for disposal of gaseous chemicals and gas mixtures and their containers, only environmentally acceptable methods are proposed. In this revision the following major changes have been made:

a) Flow chart for recommended procedure for the safe disposal of gas cylinders;
b) Provisions for disposal of unserviceable compressed gas cylinder for oxygen and oxidizing gases has been added;
c) Provisions for disposal of unserviceable compressed gas cylinder for highly corrosive and toxic gas has been added; and
d) Provisions for disposal of unserviceable compressed gas cylinder for flammable gases – hydrogen, CNG etc has been added.

In the preparation of this standard, assistance has been derived from the following standards for ascertaining unserviceable cylinders are those which fail to qualify for further use being rejected by the criteria laid down in:

a) IS 5845 : 1993 Code of practice for inspection of low pressure welded steel gas cylinders other than LPG cylinders in use (*second revision*);
b) IS 7312 : 2018 Welded and seamless steel dissolved acetylene gas cylinders — Specification (*third revision*)
c) IS 8433 : 2017 Periodic inspection and maintenance of dissolved acetylene gas cylinders — Code of practice (*second revision*)
d) IS 8451 : 2018 Periodic inspection and testing of seamless steel gas cylinders — Code of practice (*third revision*);
e) IS 5844 : 2014 Hydrostatic stretch testing of compressed gas cylinders — Recommendation; and
f) Gas Cylinder Rule, 2016

Manufacture, possession and use of any gas, when contained in cylinders in a compressed or liquefied state, is regulated under the *Gas Cylinder Rules*, 2016 of the Government of India as amended from time to time. This standard has been prepared in consultation and agreement with the statutory authorities under those rules.

Gas cylinders which are in use are subjected to wear and tear during handling. Thus, with the passage of time, they may become unsafe for further use. In order that their safety might be ascertained, gas cylinders which have been in use, are periodically inspected and tested at regular intervals. The periodical inspection comprises visual inspection, measurement of wall thickness, internal cleaning, weighing and hydrostatic testing. The gas cylinders are also subjected to external visual examination whenever they come for refilling. The inspector, on the basis of inspection, decides whether the cylinder:

a) May be taken into use as it is;
b) May be taken into use after the defect is remedied in a suitable manner; or
c) Is to be rejected and destroyed because of the nature and extent of the damage.

Unserviceable cylinders are those which fail to qualify for further use being rejected by the criteria laid down in IS 5845 'Code of practice for inspection of low pressure welded steel gas cylinders other than LPG cylinders in use', IS 8433 'Periodic inspection and maintenance of dissolved acetylene gas cylinders — Code of practice' or IS 8451 'Periodic inspection and testing of seamless steel gas cylinders — Code of practice' and considered unsafe for further use.

(*Continued on third cover*)

Indian Standard

METHODS OF DISPOSAL OF UNSERVICEABLE COMPRESSED GAS CYLINDERS — CODE OF PRACTICE

(Second Revision)

1 SCOPE

This standard covers the methods of disposal of cylinders in use which have been found to be unsuitable for further use and have been recommended to be destroyed.

2 REFERENCES

The standards listed below are necessary adjuncts to this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below.

IS No	*Title*
5844 : 2014	Hydrostatic stretch testing of compressed gas cylinders — Recommendations (*first revision*)
7312 : 2018	Welded and seamless steel dissolved acetylene gas cylinders — Specification (*third revision*)
8451 : 2018	Periodic inspection and testing of seamless steel gas cylinders — Code of practice (*third revision*)

3 IDENTIFICATION OF CYLINDER CONTENT

3.1 The first step is to identify the contents of the cylinder. If the labelling on the cylinder is not legible, clues to the contents may be obtained from the markings on the cylinder, under *Gas Cylinder Rules*, 2016 as amended from time to time, every cylinder has to be stamped permanently and legibly with the name or the chemical symbol of the gas for which the cylinder is to be used. This marking is also to be stamped on the valve. Similarly, in case of Acetylene cylinders, the marking 'ACETYLENE' to be conspicuously displayed as per IS 7312 stipulated in Notification No. GSR625(E) dated 07-08-1983.

3.2 Where no conclusion can be drawn on the identification of contents from the markings on the cylinder, this may be attempted to be established from other factors, such as ownership identification valve outlet connections etc. If the contents of the cylinder cannot be positively identified, further procedure should be carried out under the assumption that the worst possible conditions may exist.

4 DISPOSAL OF CYLINDER CONTENTS

The disposal of flammable/toxic/corrosive gases shall only be carried by trained and competent personnel with adequate facilities.

4.1 The contents of an unserviceable cylinder shall be discharged safely. The disposal method shall be according to the characteristics of the gases to be disposed and the condition of the package (cylinder and valve). Any cylinder containing a flammable gas shall be emptied under controlled conditions to the safe area using a vent line or vent stack if flaring facility is not available. Dilution with nitrogen may be required to avoid flammable atmosphere. This should be carried as per *Gas Cylinder Rules,* 2016 in the open air or through vent tubing discharging to a safe area away from the people. Toxic gases are not permitted to be released to atmosphere beyond the permissible limits as prescribed in the respective pollution control norms and personal safety of people. Adequate personal protective equipments are required based on the gases being handled.

4.2 In the event that a cylinder valve is damaged preventing the discharge of the commodity in a normal manner, the cylinder should be held firmly in a vice or clamp to prevent cylinder being swept away due to release of gas and the procedure in **4.2.1**, **4.2.2** and **4.2.3** may be applied.

4.2.1 For non-flammable non toxic gases in case the valve spindle is broken or seized, the spindle may be carefully unscrewed by means of a broken stud extractor or by any other suitable means.

4.2.2 If method under **4.2.1** is not effective, a small hole may be drilled at the back of the valve using a hand drill or sawed across the back of the valve using a fine tooth hacksaw to just sufficient depth as will reach the gas passage below the seating. The operation is stopped immediately on the first sign of escaping gas. It is desirable that during sawing or drilling operation, a small continuous jet of water is directed on to the cutter. In case of cylinders containing combustible or toxic gas, this work shall be done in the open air.

It is important that the above method of releasing cylinder contents shall be adopted by or under the supervision of experienced persons deputed by the filler of the gas, who by combination of training, experience and supervision is able to make objective judgements on the subject, deputed by the filler of the gas.

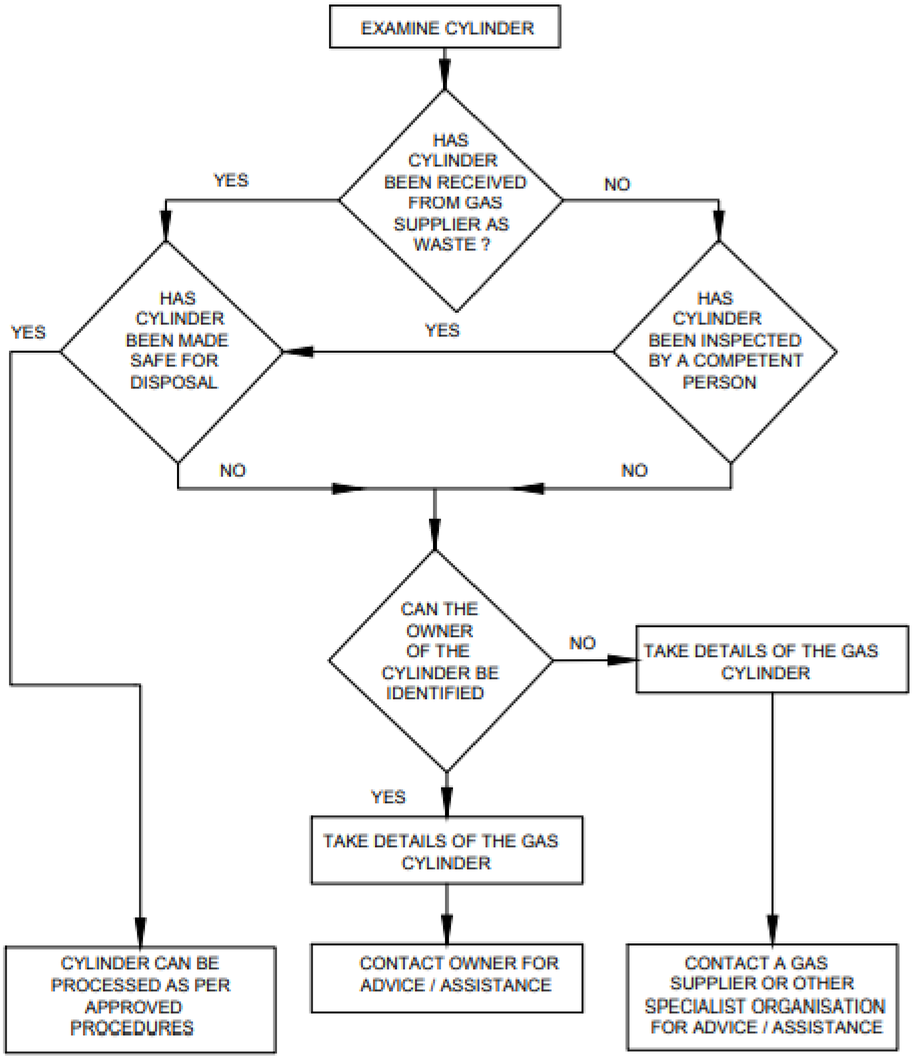
4.2.3 It may be possible to release the pressure in the cylinder through the safety device, if fitted. This method of releasing cylinder contents shall be adopted by or under the supervision of experienced persons deputed by the filler of the gas.

4.3 Many of the compressed gases may be safely vented to the atmosphere. Obviously the inert gases can be so vented without creating any undue hazard. If flammable gas or gases which may present a health hazard are vented to the atmosphere, it shall be done very carefully and at an isolated location in such a manner and at such a rate as is necessary to ensure safety from fire or contamination to the atmosphere.

4.4 After completely discharging the cylinder contents, the cylinder valve and all safety fittings may be removed. The valve shall then be carefully removed. If there is any doubt about the cylinder being properly empty, the valve shall be screwed-in firmly and the cylinder weighed so that its mass can be compared with the tare.

5 RECOMMENDED PROCEDURE FOR THE SAFE DISPOSAL OF GAS CYLINDERS

A flow chart detailing the recommended procedure for the safe disposal of gas cylinder is displayed as under:


EXAMINE CYLINDER
HAS CYLINDER BEEN RECEIVED FROM GAS SUPPLIER AS WASTE ?
YES
NO
HAS CYLINDER BEEN MADE SAFE FOR DISPOSAL
YES
YES
HAS CYLINDER BEEN INSPECTED BY A COMPETENT PERSON
NO
NO
CAN THE OWNER OF THE CYLINDER BE IDENTIFIED
NO
TAKE DETAILS OF THE GAS CYLINDER
YES
TAKE DETAILS OF THE GAS CYLINDER
CYLINDER CAN BE PROCESSED AS PER APPROVED PROCEDURES
CONTACT OWNER FOR ADVICE / ASSISTANCE
CONTACT A GAS SUPPLIER OR OTHER SPECIALIST ORGANISATION FOR ADVICE / ASSISTANCE

6 DISPOSAL OF UNSERVICEABLE CYLINDERS FILLED WITH THE GAS WHEN CONTENTS CANNOT BE DISCHARGED

It may sometimes be necessary to dispose of a cylinder which cannot be de-energized safely by releasing the pressure and removing the contents in such a case, the disposal shall be carried out in accordance with the specific instructions obtained from the statutory authority.

7 MAINTAINING A RECORD SYSTEM

Record should be made of the cylinder details. This documentation shall follow the cylinder throughout the treatment or disposal process.

The record system shall be designed such that the treatment or disposal route can be audited/verified the future.

The following points shall always be included to ensure that the treatment or disposal process can be reliably audited/verified:

a) Cylinder details;
b) Transport contractor and license details;
c) Treatment or disposal site and approval/license details;
d) Treatment or disposal date;
e) Records of the reviews of transport and treatment or disposal contractor operation regarding scrap acetylene cylinders; and
f) Records of disposal of the different wastes generated by the process (mass, cylinder, solvent etc).

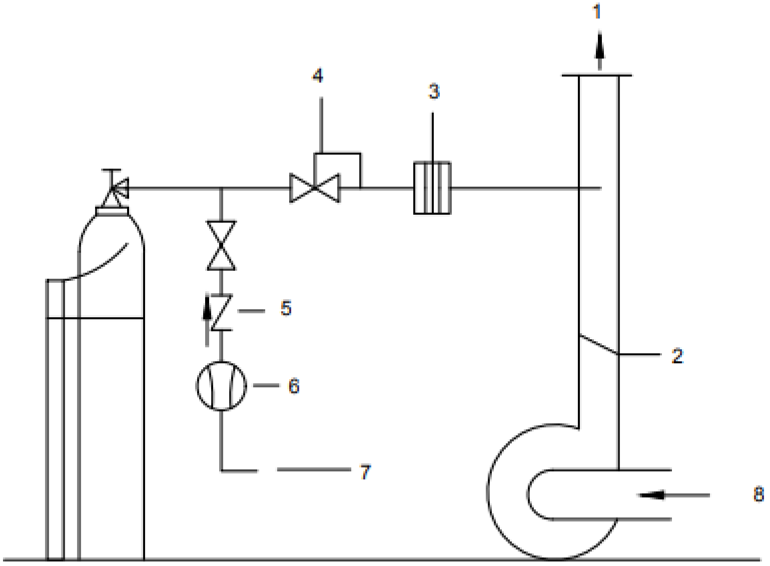
8 DETAILS OF DISPOSAL OF UNSERVICEABLE COMPRESSED GAS CYLINDER FOR HIGHLY CORROSIVE AND TOXIC GAS

8.1 Unserviceable toxic gas cylinders, such as chlorine, ammonia etc. are those which fail to qualify for further use having rejected by the criteria laid down in IS 8451 and IS 5844, and complying with other statutory standard for particular cylinders.

8.2 The cylinder containing chlorine or toxic gas or combustible gas shall be disposed of by these gas suppliers under controlled conditions.

8.2.1 *Disposal of Certain Gases*

Chlorine or toxic gases may be achieved by the method – controlled dilution in forced air stream as detailed in Fig 1.



1 DISCHARGE TO SAFE PLACE
2 AIR FLOW INDICATOR
3 FLAME ARRESTER (IF REQUIRED)
4 FLOW CONTROLLED VALVE
5 NON RETURN VALVE
6 FLOW INDICATOR
7 INLET GAS PURGE (IF REQUIRED)
8 AIR INTAKE

FIG. 1 SCHEMATIC ARRANGEMENT OF CONTROLLED DILUTION FORCED AIR STREAM

8.2.1.1 *Description of method*

Gas is discharged at a controlled rate into a forced air stream. The diluted air/waste gas mixture is then discharged to a safe place (normally at high level) under the supervision of competent person.

8.2.1.2 *Application*

This method can be used for all gases including chlorine, ammonia and toxic gases. The rate of discharge of some gases can however be low owing to the high levels of dilution required.

8.2.1.3 *Equipment design*

A pipe is connected from the container via a flow control system into a forced air stream designed to ensure adequate mixing of the waste gas with air. The dilute waste gas/air mixture is discharged to a safe place (usually at high level) away from persons and from incompatible processes and air intakes.

8.2.1.4 Only one cylinder will be connected to the system for discharging (never connect two or more cylinders for discharging.).

8.2.1.5 Necessary precautions will be more stringent than when disposal is carried out in an open and isolated region. Weather conditions can also play a part. Precautions could have to be taken when windless and inversion conditions prevail.

After discharge of chlorine/toxic gases the system should be purged with inert gas (such as Nitrogen before disconnecting the system).

8.2.1.6 Safety valve, if fitted with valve may be cracked open to discharge the gas very slowly in a well-ventilated area. Forced air stream may be provided to disperse the corrosive gas to avoid concentration of corrosive gas. This method has to be undertaken under the supervision of competent person.

8.2.1.7 Install Safety showers and eye washed stations near works area.

8.2.1.8 If there is any doubt about the cylinder being properly empty, the valve shall be screwed-in firmly and the cylinder weighed so that its mass can be compared with the tare (in case of liquefiable gas).

8.3 Once the cylinder has been successfully emptied of the gas contents, the cylinder valve can be removed. De-valving, if requires, by using a suitable device as illustrated in Fig. 2 and shall take place in open air or in a ventilation area under the supervision of a competent person. After the removal of the valve and safety fittings (if fitted with) the cylinder shall be kept aside for some time.

8.3.1 All the markings on the cylinder shall be defaced beyond recognition and “CONDEMNED” shall be punched deeply on the shoulder in capital letters of 12 mm size.

8.3.2 Crushing the cylinder as flat as possible by mechanical means.

8.3.3 Cutting irregular in the neck or base.

8.3.4 Cutting the cylinder in half in irregular manner including the shoulder by using a hacksaw.

8.3.5 The cylinder neck threads shall be completely damaged in such a manner as to render the cylinder unserviceable.

NOTE — The list of gases which should be covered under this category is given in Annex A.

9 DETAILS OF DISPOSAL OF UNSERVICEABLE COMPRESSED GAS CYLINDER FOR OXYGEN & OXIDIZING GASES

9.1 Disposal of oxidizing cylinders namely, oxygen, nitrous oxide cylinders etc. are those who failed to qualify for further use having rejected by the criteria laid down in IS 8451 and IS 5844.

9.2 The cylinder should be firmly held in vice or clamp during venting to prevent any free movement of cylinder due to escaping of gas at high velocity. The residual gas should be vented to atmosphere in a well-ventilated area. No smoking or naked flames should be allowed in the vicinity as it may cause or intensity of fire, oxidizer contents in the gas under pressure may explore, if heated. No oils/lubricants should be allowed in vicinity as the oxidization may cause explosion.

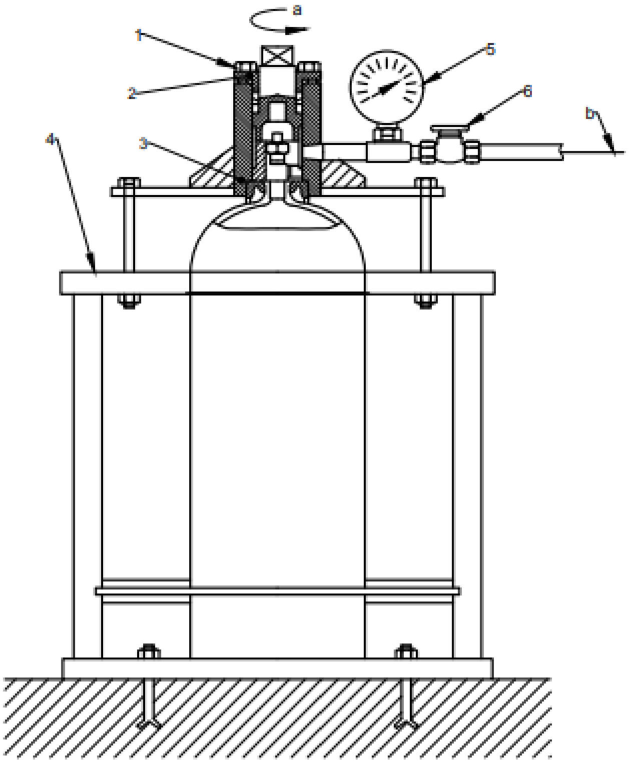
9.2.1 In case the valve spindle is broken or seized, the spindle may be carefully unscrewed by means of a stud extractor.

9.2.2 If method **9.2.1** is not effective, a small hole may be drilled at the back of the valve using a hand drill or sawed across the back of the valve using a fine tooth hacksaw to just sufficient depth as will reach the gas passage below the seating. The operation is stopped immediately on the first sign of escaping gas. It is desirable that during sawing or drilling operation, a small continuous jet of water is directed on to the cutter.

The above method of releasing cylinder contents shall be adopted by or under the supervision of experienced persons deputed by the filler of gas.

9.2.3 After completely discharging the cylinder contents, the cylinder valve may be removed.

9.2.4 Subsequent to complete discharge of the cylinder contents and removal of the cylinder valve from an unserviceable cylinder, the cylinder shall be purged. Purging can be accomplished with the use of nitrogen stream or by filling the cylinder with water.



KEY

1	DRIVE FOR DE - VALVING MACHINE
2	GAS - TIGHT GLAND
3	GAS - TIGHT SEAL
4	CYLINDER FRAME AND CLAMPING DEVICE
5	PRESSURE GAUGE
6	VENT VALVE
a	DIRECTION OF ROTATION
b	TO GAS DISPOSAL

FIG. 2 DE-VALVING

9.2.5 All the markings on the cylinder shall be defaced beyond recognition and "CONDEMNED" shall be punched deeply on the shoulder in capital letters of 12 mm size.

9.2.6 Crushing the cylinder as flat as possible by mechanical means.

9.2.7 Cutting irregular hole in the neck or base.

9.2.8 Cutting the cylinder in half in irregular manner including the shoulder by using any suitable method.

9.2.9 The cylinder neck threads shall be completely damaged in such a manner as to render the cylinder unserviceable.

NOTE — The list of gases which should be covered under this category is given in Annex B.

10 DETAILS OF DISPOSAL OF UNSERVICEABLE COMPRESSED GAS CYLINDER FOR INERT GAS – ARGON AND NITROGEN ETC

10.1 Disposal of Inert gas cylinders namely, argon, helium, neon, nitrogen are those who failed to qualify for further use having rejected by the criteria laid down in IS 8451 and IS 5844.

10.2 The cylinder should be held firmly in vice or clamp during venting to prevent any free movement of cylinder due to escaping of gas at high velocity. The residual gas should be vented to atmosphere in a well-ventilated area. The gas to be released slowly into the atmosphere. Direct discharge from the cylinder valve may be carried out as per the Fig 3.

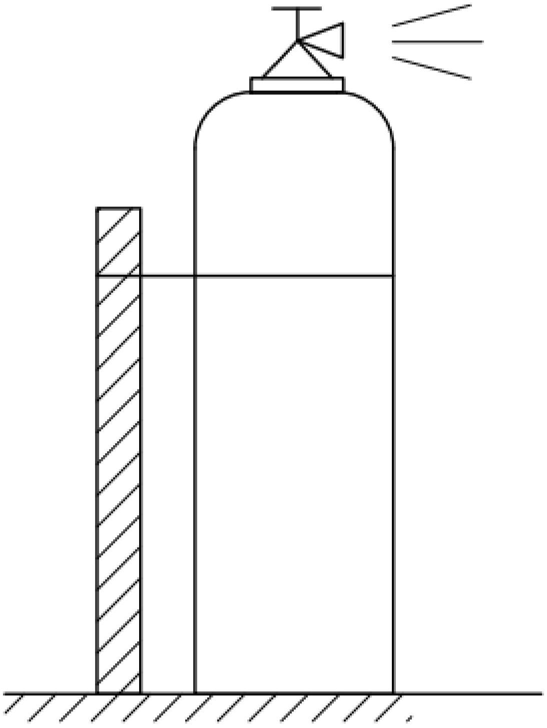


FIG. 3 SCHEMATIC ARRANGEMENT FOR DIRECT DISCHARGE FROM CYLINDER

10.2.1 *Description of Method*

Gas is discharged directly from the cylinder valve to the atmosphere.

10.2.1.1 *Equipment design*

All that is required is a means of opening the cylinder valves. The valve should be positively supported.

10.2.1.2 The valve is opened slowly to permit gas discharge at an appropriate rate. Only one cylinder would be discharged at a time.

10.2.1.3 *Operational precautions*

The operation should be carried in a well-ventilated area away from incompatible processes like flammable gases, hydrogen, methane etc., air intakes and away from persons not engaged in the disposal operations. Consideration should be given to ensure safe dispersion of vented gases.

10.3 In case the valve spindle is broken or seized, the spindle may be carefully unscrewed by means of a stud extractor or by any other suitable means.

10.3.1 If method **10.3** is not effective, a small hole may be drilled at the back of the valve using a hand drill or sawed across the back of the valve using a fine tooth hacksaw to just sufficient depth as will reach the gas passage below the seating. The operation is stopped immediately on the first sign of escaping gas. It is desirable that during sawing or drilling operation, a small continuous jet of water is directed on to the cutter. In case of cylinders containing combustible or toxic gas, this work shall be done in the open air.

The above method of releasing cylinder contents shall be adopted by or under the supervision of experienced persons deputed by the filler of gas.

10.3.2 After completely discharging the cylinder contents, the cylinder valve may be removed.

10.3.3 Subsequent to complete discharge of the cylinder contents and removal of the cylinder valve from an unserviceable cylinder, the cylinder shall be purged. Purging can be accomplished with the use of nitrogen steam or by filling the cylinder with water.

10.3.4 All the markings on the cylinder shall be defaced beyond recognition and "CONDEMNED" shall be punched deeply on the shoulder in capital letters of 12 mm size.

10.3.5 Crushing the cylinder as flat as possible by mechanical means.

10.3.6 Cutting irregular in the neck or base.

10.3.7 Cutting the cylinder in half in irregular manner including the shoulder by using a suitable method.

10.3.8 The cylinder neck threads shall be completely damaged in such a manner as to render the cylinder unserviceable.

NOTE — The list of gases which should be covered under this category is given in Annex C.

11 DETAILS OF DISPOSAL OF UNSERVICEABLE COMPRESSED GAS CYLINDER FOR FLAMMABLE GASES – HYDROGEN, CNG ETC.

11.1 Disposal of Flammable gas cylinders namely, hydrogen, methane, ethylene, ethane, propylene, isobutylene, LPG and deuterium are those who failed to qualify for further use having rejected by the criteria laid down in IS 8451 and IS 5844; and complying with other statutory standard for particular cylinders.

11.2 Disposal of Cylinder Contents

11.2.1 The residual gas to be vented to atmosphere in a well-ventilated area. The gas to be released very slowly into the atmosphere. Direct discharge from the cylinder may be carried out as per the Fig 4.

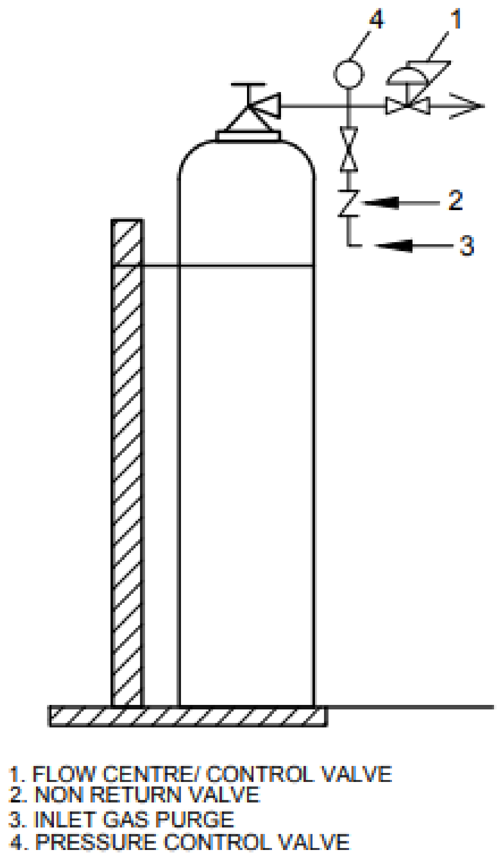


FIG. 4 A SCHEMATIC ARRANGEMENT FOR DIRECT DISCHARGE OF RESIDUAL GAS

11.2.1.1 *Description of operation*

The gas to be disposed to the atmosphere.

A flow of inert gas is to be maintained throughout the process of disposal of gas. Flow control valve to be regulated and to be adjusted pressure control valve as appropriate. A jet of water flow may be provided at the disposal point to avoid any hazard. Slowly open the flow control valve.

11.2.1.2 *Operational precaution*

This operation should be carried out in a well-ventilated area or open area.

Constant vigilance is necessary to ensure to check if there is any flame (in case of hydrogen cylinder). A hydrogen flame is very pale and cannot be seen in bright daylight. Other indications must be used, for example, a piece of paper/dry cloth into the suspected area.

11.2.1.3 *Precautions*Ignition sources (including open flames, electrical equipment and static discharge) should be excluded if the waste gas is flammable or if flammable, gases can be produced. Care should be taken to avoid build-up of potentially explosive flammable gas/air mixtures in and around the system.

Disposal process to be carried out in presence of competent person only as it is necessary to ensure safety from fire or contamination of the atmosphere.

11.2.1.4 In case the valve spindle is broken or seized, the spindle may be carefully unscrewed by means of a stud extractor or by any other suitable means.

11.2.1.5 If the method **11.2.1.4** is not effective, a small hole may be drilled at the back of the valve using a hand drill or sawed across the back of the valve using a fine tooth hacksaw to just sufficient depth as will reach the gas passage below the seating. The operation is stopped immediately on the first sign of escaping gas. It is desirable that during sawing or drilling operation, a small continuous jet of water is directed on to the cutter. This work shall be done in the open air.

The above method of releasing cylinder contents shall be adopted by or under the supervision of experienced persons.

11.2.1.6 After completely discharging the cylinder contents, the cylinder valve may be removed.

11.2.1.7 If there is any doubt about the cylinder being properly empty, the valve shall be screwed-in firmly and the cylinder weighed so that its mass can be compared with the tare.

11.2.1.8 Subsequent to complete discharge of the cylinder contents and removal of the cylinder valve from an unserviceable cylinder the cylinder shall be purged with inert gas.

NOTE — The list of gases which should be covered under this category is given in Annex D.

12 DETAILS OF DISPOSAL OF UNSERVICEABLE COMPRESSED GAS CYLINDER FOR ACETYLENE GAS

12.1 Disposal of Unserviceable Dissolved Acetylene Cylinders

Unserviceable dissolved acetylene gas cylinders are those which fail to qualify for further use being rejected by the criteria laid down in IS 8433.

12.1.1 *Discharge of the Cylinder Contents*

These cylinders should be held firmly in vice or clamp during venting to prevent any free movement of cylinder due to escaping of gas at high velocity. These cylinders shall be depressurized of gas.

12.1.2 Cylinders shall be checked for pressure both before and after depressurization.

12.1.3 Depressurization shall be carried out in a safe manner having due regards to the characteristics of acetylene.

12.1.4 Depressurization shall be carried out over a long enough time to ensure removal of acetylene except saturation gas. Cylinders shall be depressurized using suitably designed blow down manifold only for at least 24 h. Precaution shall be taken because variation in temperature influence the quantity of Acetylene in the form of Saturation gas. This is a potential safety hazard against which suitable precaution should be taken as the result in vapour will be saturated with solvent and heavier than air. For example, cylinder can be connected to vent manifold or kept in a separate area.

The absence of a positive reading does not necessarily indicate the absence of excess gas due to the possibility of a blocked valve. It is therefore essential to check for blocked valve or filter pad.

A suitable method to check this is the introduction of compressed nitrogen (or other inert gas at a pressure below 1 bar) and observing its discharge is given below:

a) Valve 'A' is closed;
b) Valve 'B' is opened until gauge 'P' registers 1 bar; and
c) Valve 'B' is then closed. If the indicated pressure does not decay that is, there are no leaks in the connections, then valve 'A' is opened. Rapid decay of indicated pressure indicates valve 'A' is not blocked as the gas in the manifold flows into the cylinder.

This can be achieved for example by the arrangement shown in Fig. 5.

12.1.5 In case of any doubts regarding the efficiency of depressurization cycle, the cylinder shall be weighed. If it is found that the valve is obstructed, then a suitable method shall be employed to remove the gas or the valve, taking into consideration design of the valve and taking all necessary precautions having due regard to the hazards that can result from an uncontrolled operation.

12.1.6 Once the cylinder has been successfully emptied of acetylene gas, cylinder valve can be removed. Only one cylinder at a time to avoid concentration of acetylene and thus avoiding hazard.

De-valving if requires, by using a suitable device as illustrated in the drawing as per Fig. 2 and shall take place in an open air or in a well-ventilated area. After the removal of the valve and safety fittings, these cylinders shall be allowed to remain in the open air for at least 4 weeks. This will allow any small amount of acetylene which can remain in the cylinders after blow down process described in **11.1.4**. While using this arrangement, it should be noted that some gas leak may occur through the gap in between neck ring and cylinder neck.

12.1.7 If the disposal method of land fill requires removal of solvent (acetone), it can be removed to minimum by heating the Acetylene in the water bath at 85 °C for 12 hours.

12.1.8 All the markings on the cylinder shall be defaced beyond recognition and the 'CONDEMNED' shall be punched deeply on the shoulder in capital letters of 12 mm size.

12.1.9 Then one or more of the following procedures should be followed.

12.1.9.1 Crushing the cylinder as flat as possible by mechanical means.

12.1.9.2 Cutting irregular holes in the neck or base.

12.1.9.3 Cutting the cylinder in half in irregular manner including the shoulder by using a hacksaw under controlled conditions. Care shall be taken to avoid asbestos exposure if the cylinder porous mass contains asbestos and also fire hazard if solvent is not completely removed.

12.1.9.4 The cylinder neck threads shall be completely damaged in such a manner so as to render the cylinder unserviceable.

12.2 The porous mass may be removed from the shell and the shell shall be destroyed.

12.3 Solvent Removal

12.3.1 It is strongly recommended that the solvents be reduced to lowest practicable quantity, particularly in the case of DMF.

12.3.2 The solvent should preferably be recovered in a condenser or, if this is not technically or economically possible, vented it to a controlled location (for acetone solvent).

12.4 Flow Chart

Guidelines for management of waste acetylene cylinders as in Fig. 6.

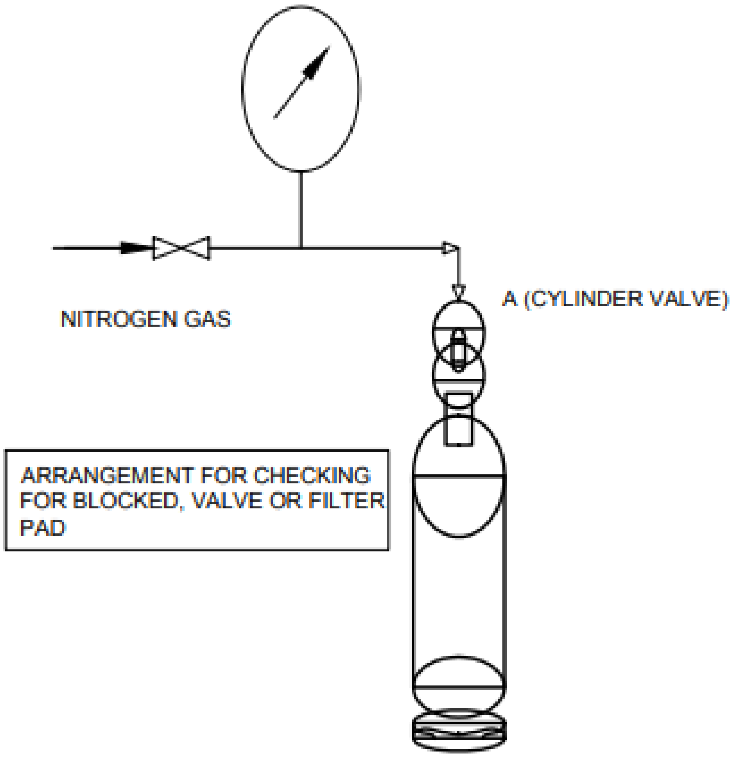
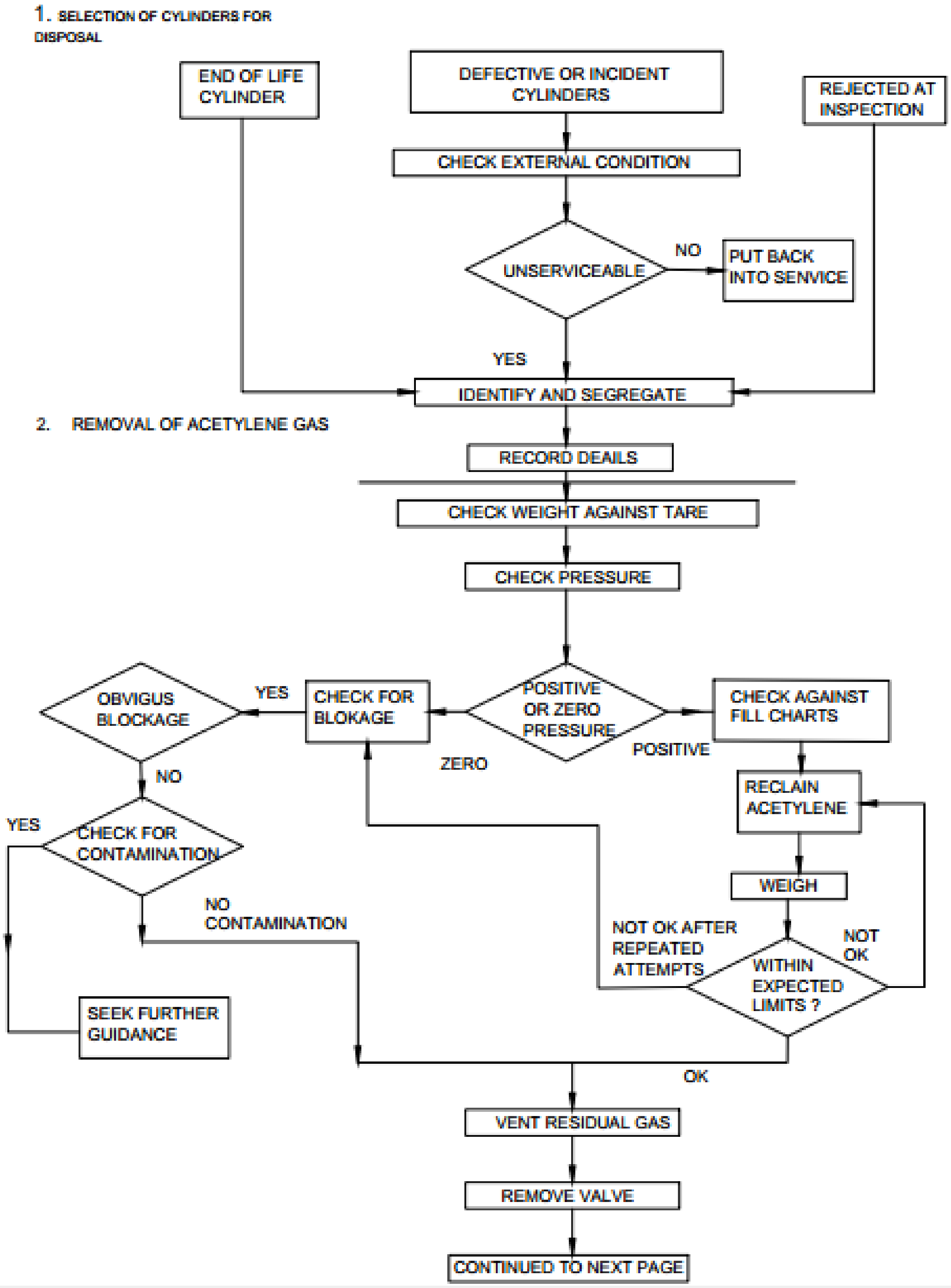


Fig. 5 Illustration for Blocked Valve


1. SELECTION OF CYLINDERS FOR DISPOSAL
END OF LIFE CYLINDER
DEFECTIVE OR INCIDENT CYLINDERS
REJECTED AT INSPECTION
CHECK EXTERNAL CONDITION
UNSERVICEABLE
NO
PUT BACK INTO SENVICE
YES
IDENTIFY AND SEGREGATE
2. REMOVAL OF ACETYLENE GAS
RECORD DEAILS
CHECK WEIGHT AGAINST TARE
CHECK PRESSURE
OBVIGUS BLOCKAGE
YES
CHECK FOR BLOKAGE
POSITIVE OR ZERO PRESSURE
CHECK AGAINST FILL CHARTS
POSITIVE
ZERO
NO
RECLAIN ACETYLENE
YES
CHECK FOR CONTAMINATION
WEIGH
NO CONTAMINATION
NOT OK AFTER REPEATED ATTEMPTS
WITHIN EXPECTED LIMITS ?
NOT OK
SEEK FURTHER GUIDANCE
OK
VENT RESIDUAL GAS
REMOVE VALVE
CONTINUED TO NEXT PAGE

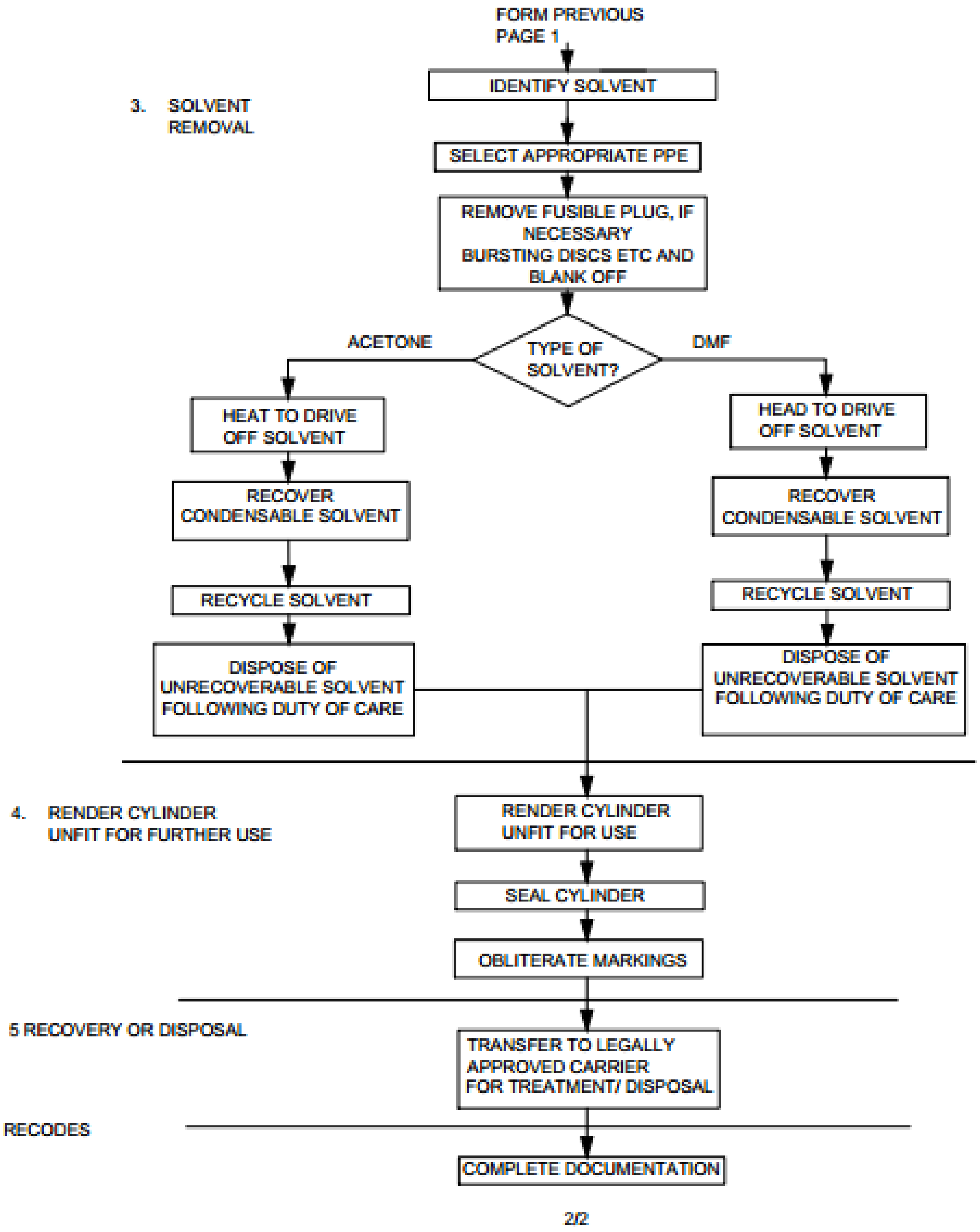

FORM PREVIOUS PAGE 1
3. SOLVENT REMOVAL
IDENTIFY SOLVENT
SELECT APPROPRIATE PPE
REMOVE FUSIBLE PLUG, IF NECESSARY BURSTING DISCS ETC AND BLANK OFF
ACETONE
TYPE OF SOLVENT?
DMF
HEAT TO DRIVE OFF SOLVENT
HEAD TO DRIVE OFF SOLVENT
RECOVER CONDENSABLE SOLVENT
RECOVER CONDENSABLE SOLVENT
RECYCLE SOLVENT
RECYCLE SOLVENT
DISPOSE OF UNRECOVERABLE SOLVENT FOLLOWING DUTY OF CARE
DISPOSE OF UNRECOVERABLE SOLVENT FOLLOWING DUTY OF CARE
4. RENDER CYLINDER UNFIT FOR FURTHER USE
RENDER CYLINDER UNFIT FOR USE
SEAL CYLINDER
OBLITERATE MARKINGS
5 RECOVERY OR DISPOSAL
TRANSFER TO LEGALLY APPROVED CARRIER FOR TREATMENT/ DISPOSAL
RECODES
COMPLETE DOCUMENTATION
2/2

Fig. 6 Typical Flow Chart - Guidelines for Management of Waste Acetylene Cylinders

NOTE

DMF — Dimethyl Formamide

It is frequently used for chemical reactions and other applications, which require a high solvency power. The product is known as universal solvent. The high solubility of Polycrylonile in DMF, together with the miscibility of DMF in water makes DMF the preferred solvent for the production of acrylic fibres.

ANNEX A

(*Clause* 8.3.5)

HIGHLY CORROSIVE AND TOXIC GASES

UN NO.	GAS NAME	CHEMICAL FORMULAE
2190	Oxygen difluoride	OF_2
1741	Boron trichloride	BCl_3
1067	Dinitrogen tetroxide. (Nitrogen dioxide)	N_2O_4
1076	Phosgene	$COCl_2$
2195	Tellurium hexafluoride	TeF_6
3057	Trifluoroacetyl chloride	C_2ClF_3O
2196	Tungsten hexafluoride	WF_6
2198	Phosphorus pentafluoride	PF_5
2420	Hexafluoroacetone	C_3F_6O
2194	Selenium hexafluoride	SeF_6
1079	Sulphur dioxide	SO_2
2191	Sulphuryl fluoride	SO_2F_2
2417	Carbonyl fluoride	CF_2O
1859	Silicon tetrafluoride	SiF_4
1242	Methyldichlorosilane	$SiH(CH_3)Cl_2$
1048	Hydrogen bromide	HBr
2197	Hydrogen iodide	HI
1016	Carbon monoxide	CO
1045	Fluorine	F_2
1660	Nitric oxide	NO
1005	Ammonia. anhydrous	NH_3
2901	Bromine chloride	BrCl
1017	Chlorine	Cl_2
2548	Chlorine pentafluoride	ClF_5
1589	Cyanogen chloride	ClCN
1040	Ethylene oxide	C_2H_4O
1053	Hydrogen sulphide	H_2S
1062	Methyl bromide	CH_3Br
1069	Nitrosyl chloride	ClNO
3083	Perchloryl fluoride	$ClFO_3$
2418	Sulphur tetrafluoride	SF_4
1008	Boron trifluoride	BF_3
1050	Hydrogen chloride	HCl
1745	Bromine pentafluoride	BrF_5
1746	Bromine trifluoride	BrF_3
1183	Ethyldichlorosilane	$SiH(C_2H_5)Cl_2$
1790	Hydrofluoric acid, solution	HF in H_2O
1052	Hydrogen fluoride, anhydrous	HF

UN NO.	GAS NAME	CHEMICAL FORMULAE
2495	Iodine pentafluoride	IF_5
1994	Iron pentacarbonyl	$Fe(CO)_5$
1259	Nickel carbonyl	$Ni(CO)_4$
1295	Trichlorosilane	$SiHCl_3$
2978	Uranium hexafluoride	UF_6

ANNEX B

(*Clause* 9.2.9)

OXYGEN AND OXIDIZING GASES

UN NO.	GAS NAME	CHEMICAL FORMULAE
2190	Oxygen difluoride	OF_2
1072	Oxygen	O_2
2451	Nitrogen trifluoride	NF_3
1070	Nitrous oxide	N_2O
1749	Chlorine trifluoride	ClF_3

ANNEX C

(*Clause* 10.3.8)

INERT GASES

UN NO.	GAS NAME	CHEMICAL FORMULAE
1002	Air	–
1006	Argon	Ar
1046	Helium	He
1056	Krypton	Kr
1065	Neon	Ne
1066	Nitrogen	N_2
1013	Carbon dioxide	CO_2
2036	Xenon	Xe

ANNEX D

(*Clause* 11.2.1.9)

FLAMMABLE GASES

UN NO.	GAS NAME	CHEMICAL FORMULAE
1957	Deuterium	D_2
1049	Hydrogen	H_2
1971	Methane	CH_4
	Compressed Natural gas	
2035	1,1,1-Trifluoroethane, (Refrigerant gas R 143a)	CF_3CH_3
1030	1,1-Difluoroethane, (Refrigerant gas R 152a)	CHF_2CH_3
1010	1,2-Butadiene, stabilized	$CH_2:C:CHCH_3$
1010	1,3-Butadiene	$CH_2:CH::CH:CH_2$
1012	1-Butylene	$CH_2::CHC_2 H_5$
2517	1-Chloro-1,1-difluoroethane(Refrigerant gas R 142b)	$CClF_2CH_3$
2044	2,2-Dimethylpropane	$CH_3C(CH_3)_2CH_3$
2419	Bromotrifluoroethylene	C_2BrF_3
1012	cis-2-Butylene	$CH_3CH::CHCH_3$
2601	Cyclobutane	$C_4 H_8$
1027	Cyclopropane	C_3H_6
3252	Difluoromethane (Refrigerant gas R 32)	CH_2F_2
1033	Dimethyl ether	CH_3OCH_3
	Dimethylsilane	C_2H_8Si
2452	Ethyl acetylene	C_2H_5CCH
2453	Ethyl fluoride (Refrigerantgas R 161)	C_2H_5F
1039	Ethyl methyl ether	$C_2H_5OCH_3$
2202	Hydrogen selenide	H_2Se
1969	Isobutane	$CH_3CH(CH_3)CH_3$
1055	Isobutylene	$CH_2:C(CH_3)_2$
1011	*n*-Butane	C_4H_{10}
3154	Perfluoro(ethyl vinyl ether)	$C_4 F_8O$
3153	Perfluoro(methyl vinyl ether)	$C_3 F_6O$
2200	Propadiene	C_3H_4
1978	Propane	$C_3 H_8$
1077	Propylene	C_3H_6
1012	trans-2-Butylene	$CH_3CH::CHCH_3$
1087	Vinyl methyl ether	$C_2H_3OCH_3$
1959	1.1-Difluoroethylene. (Refrigerant gas R 1132a)	CF_2CH_2
1035	Ethane	C_2H_6

UN NO.	GAS NAME	CHEMICAL FORMULAE
1962	Ethylene	C_2H_4
2454	Methyl fluoride (Refrigerantgas R 41)	CH_3F
2203	Silane [pyrophoric]	SiH_4
1081	Tetrafluoroethylene	C_2F_4
1860	Vinyl fluoride	C_2H_3F
1026	Cyanogen	$(CN)_2$
1259	Nickel carbonyl	$Ni(CO)_4$
2188	Arsine	AsH_3
2204	Carbonyl sulphide	COS
2189	Dichlorosilane	SiH_2Cl_2
1032	Dimethylamine	$NH(CH_3)_2$
1037	Ethyl chloride (Refrigerant gas R 160)	C_2H_5Cl
1036	Ethylamine	$NH_2C_2H_5$
1063	Methyl chloride. (Refrigerant gas R 40)	CH_3Cl
2534	Methyl chlorosilane	CH_5ClSi
1064	Methyl mercaptan	CH_3SH
1061	Methylamine	NH_2CH_3
2676	Stibine	SbH_3
1082	Trifluorochloroethylene	C_2ClF_3
1083	Trimethylamine	$N(CH_3)_3$
1085	Vinyl bromide	C_2H_3Br
1086	Vinyl chloride	C_2H_3Cl
1911	Diborane	B_2H_6
2192	Germane	GeH_4
2199	Phosphine	PH_3
1366	Diethylzinc	$(C_2H_5)_2Zn$
1051	Hydrogen cyanide	HCN
1242	Methyldichlorosilane	$SiH(CH_3)Cl_2$
1380	Pentaborane	B_5H_9
1077	LPG	LPG

ANNEX E

(*Foreword*)

COMMITTEE COMPOSITION

Gas Cylinder Sectional Committee, MED 16

Organization	*Representative(s)*
Petroleum And Explosive Safety Organization, Nagpur	Shri M. K. Jhala (***Chairman***) Shri V. K Mishra (*Alternate* I) Shri Jamunalal Rout (*Alternate* II)
All India Industrial Gases Manufacturers Association, New Delhi	Shri Saket Tiku Shri K. R. Sahasranam (*Alternate*)
Ashok Leyland Limited, Chennai	Shri Ved Prakash Gautam Shri Faustino V. (*Alternate*) Shri Suchismita Chatterjee (*Young Professional*)
Automotive Research Association of India, Pune	Dr S. S. Thipse Shri S. D. Rairikar (*Alternate*)
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Everest Kanto Cylinder Ltd, Mumbai	Shri Ghanshyam Goyal Shri A. K. Khamkar (*Alternate* I) Shri A. S. V. S. Prasad (*Alternate* II)
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Indraprastha Gas Limited, Delhi	Shri Ujwal Bhandari Shri Sushil Kumar (*Alternate*) Shri Aviral Rajeev (*Young Professional*)
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Organization	*Representative(s)*
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Shri Chandan Gupta
Scientist 'D' (MED), BIS

(*Continued from second cover*)

The proper and safe disposition of unserviceable compressed gas cylinders is important as a substantial potential hazard may exist that should be recognized and evaluated by those who attempt to dispose them of. If the contents of cylinder are unknown and there is no ready means for identifying its properties, the hazard is specially great. Compressed gas cylinders may have a very high energy content, for some are charged to high pressures. Cylinders may be charged with the flammable gases which, when released to atmosphere, may form explosive mixtures with air or may form explosives mixtures within the container, if the disposal procedure is improper. Some cylinders may contain toxic or poisonous substances or materials that are highly corrosive or reactive.

In preparing this standard, an attempt has been made to anticipate practical considerations that might arise. The standard does not cover all possible circumstances, nor does it contain all remedies. However, it is expected that the standard shall serve a useful purpose and shall be of aid to those engaged in the compressed gas. Industrial as well as others who may have an interest, such as fire services, persons engaged in scrap metal industries, or individuals that may at some time or other be faced with problem of safe disposition of unserviceable cylinders.

It is not to be assured that every acceptable safety procedure is contained or that abnormal or unusual circumstances may not warrant or require further or additional procedures other than those recommended in this standard.

The composition of the Committee responsible for the formulation of this standard is given in Annex E.

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